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Title of Invention: A side sill structure

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1. Title of Invention

A Side Sill Structure

2. Scope of Utility Model Claims

1. A side sill structure in which at least one hollow pipe is fitted into a side sill of an automobile, and a gap is filled with a foamed material between the hollow pipe and the side sill.

3. Detailed Explanation of the Invention

The present invention relates to a side sill structure which is served for coping with a side collision of an automobile.

As a countermeasure to cope with a side collision of an automobile, conventionally, the reinforcement of a side sill structure has been one of tasks to be solved. To reinforce such a side sill structure, there has been proposed a structure which fills a filling material in a hollow portion of a side sill. This structure is explained in detail hereinafter in conjunction with drawings.

Fig. 1 is a view showing a side sill portion of an automobile and Fig. 2 is a cross-sectional view taken along a line A-A in Fig. 1. As shown in Fig. 2, a side sill 1 is comprised of a side sill outer panel 2 and a side sill inner panel 3 and the side sill inner panel is bonded to a floor panel 4. To prevent a wall surface buckling of the side sill outer panel 2, a hard foamed material 5 is injected and filled in the side sill 1.

Here, such a conventional side sill structure is configured such that the foamed material is injected to fill the whole area in the side sill and hence, there arises a drawback that a large amount of expensive foamed material is used and this pushes up a cost.

Accordingly, it is an object of the present invention to solve such a conventional drawback and to provide an inexpensive and lightweight side sill structure to ensure the strength which can prevent a wall surface buckling of a side sill at the time of side collision of an automobile.

To achieve such an object, the side sill structure of the present invention is characterized by inserting at least one hollow pipe into a side sill of an automobile, and filling a gap between the hollow pipe and the side sill with a foamed material.

The side sill structure of the present invention is explained in detail hereinafter in conjunction with drawings. Fig. 3 is a cross-sectional view corresponding to a line A-A in Fig. 1 and shows an embodiment of the side sill structure of the present invention. In Fig. 3, a side sill 1 is constituted

of a side sill outer panel 2 and a side sill inner panel 3, and the side sill inner panel 3 is bonded to a floor panel 4. In the side sill 1, a hollow pipe 6 is inserted and a gap between the hollow pipe 6 and the side sill 1 is filled with a foamed material 5. As a material of the hollow pipe 6, steel, aluminum, FRP and the like can be used. However, beside these materials, any lightweight material which has proper rigidity can be used.

Next, the manner of operation of the side sill structure of the present invention having such a constitution at the time of side collision is explained. Since the side sill of the present invention has a sandwich structure formed of the side sill 1 and the hollow pipe 6, the rigidity is increased. Accordingly, when an impact is imparted to the side sill, an invasion stroke into the car chamber can be reduced. Further, the maximum strength can be increased by an amount corresponding to the hollow pipe compared to the conventional side sill shown in Fig. 2.

Next, another embodiment of the hollow pipe which is inserted into the side sill of the present invention is explained in detail. Fig. 4 shows a side sill structure in which a hollow pipe 6 is inserted into the side sill 1 in conformity with a shape of the side sill 1 thus further reducing an amount of a foamed material 5. Fig. 5 shows a side sill structure in which hollow pipes 7, 7' are separately or integrally formed, planar portions are provided to respective wall portions and these planar portions are brought into close contact with each other thus giving an effect of a baffle plate to the hollow pipes 7,

7'. Fig. 6 shows a side sill structure in which two hollow pipes 8, 8' are inserted into the side sill 1 in a spaced-apart manner.

Next, an example of a method for manufacturing a side sill structure of the present invention is explained in detail in conjunction with Fig. 7 and Fig. 8. Plates 9 for preventing flow-out of a foaming liquid are fitted on both end portions of the hollow pipe 6. The pipe 6 is inserted into the side sill 1 on a metal line for car bodies. The side sill outer panel 2 and the side sill inner panel 3 are spot-welded together with the plates 9. Then, the side sill structure is coated together with the car body and, thereafter, as shown in Fig. 8, a foaming liquid 5a is injected from an upper portion of the side sill 1 by a gun 10 and is foamed. Although an iron plate, plastic or the like may be used as a material of the plate 9, any other material which has proper strength can also be used.

Next, another example of method for manufacturing the side sill structure according to this invention is explained in conjunction with Fig. 9 to Fig. 11. In this manufacturing method, at the time of assembling the side sill shown in Fig. 7 in the previously-mentioned manufacturing method, a heating type foaming material 5b is inserted into the side sill 1 as shown in Fig. 9, and the foaming material 5b is foamed by heat when the side sill 1 is made to pass through a coating furnace so that the inside of the side sill 1 is filled with a foamed material 5 as shown in Fig. 10. It is not always necessary to provide the heating type foaming material 5b such that the foaming material 5b wraps the hollow pipe 6 as shown in Fig. 9, and the

foaming material 5b may be inserted into any position so long as the position is disposed between the side sill 1 and the hollow pipe 6. Further, the shape of the foaming material 5b at the time of insertion may have any shape. The foaming material 5b is usually obtained by extrusion molding.

Fig. 11 shows another embodiment of a heating type foaming material 5b. In this embodiment, the heating type foaming material 5b is formed on a substrate 11 such that the foaming material 5b is fixedly secured to the substrate 11, and a glass sheet 12 is made to cover the heating type foaming material 5b, a surface of the glass sheet 12 is covered with a vinyl 13, a tacky adhesive agent 14 is provided to a rear surface of the substrate 11, and a surface of the tacky adhesive agent 14 is covered with a peelable sheet 15 thus preparing the heating type foaming material 5b of this embodiment. Then, at the time of assembling the side sill 1 as shown in Fig. 7, the heating type foaming material 5b is mounted on a given position of an inner wall of the side sill 1 or an outer wall of the hollow pipe 6 after peeling off the peelable sheet 15 shown in Fig. 11. In the same manner as the embodiment shown in Fig. 9 and Fig. 10, the heating type foaming material 5b is foamed by heat obtained when the side sill 1 is made to pass through a coating furnace after the side sill 1 is assembled. In this embodiment, however, since the glass sheet 12 is placed on the heating type foaming material 5b, at the time that the foaming material is foamed, the glass sheet 12 is arranged between the foam materials whereby the produced foamed material is reinforced by the glass sheet

12.

In addition to the abovementioned embodiments, the foaming material 5b may be fixed inside the side sill using a pressure sensitive adhesive double-coated tape. As the foaming material which uses the heating type foaming material 5b, epoxy foam (foaming material being a hydrazide-based compound), polyethylene foam or the like can be used.

Next, the manner of forming the foamed material by foaming the heating type foaming material 5b is explained. A car body in which the heating type foaming material is incorporated into the side sill in the state shown in Fig. 9 is heated by making the car body pass through a coating furnace. As shown in Fig. 12, with the lapse of heating time, the volume of the foaming material 5b which is indicated by a characteristic curve A is increased, while the viscosity of resin which is indicated by a characteristic curve B is lowered from the unhardened state after starting of heating. When the viscosity of resin assumes the lowest level, the foaming material 5b is foamed. Upon completion of foaming, the hardness is increased due to the hardening reaction and the side sill 1 is filled with the foamed material 5 as shown in Fig. 10.

As has been explained heretofore in detail, the side sill structure of the present invention inserts the separate hollow pipe into the side sill to fill a gap between the side sill and the hollow pipe with the foamed material. Accordingly, the rigidity and strength of the side sill can be increased. The manufacturing cost can be reduced. The magnitude of the absorbed

energy by the side sill can be increased or decreased by adopting hollow pipes of various shapes and constitutions and hence, the side sill is applicable to various vehicles. Unlike the prior art, it is possible to cope with the side collision without changing the plate thickness. In this manner, the present invention provides the side sill structure which has various advantageous effects including the abovementioned advantageous effects.

In addition to the abovementioned advantageous effects, by manufacturing the side sill using the manufacturing method shown in Fig. 9 to Fig. 11, it is possible to foam the foaming material when the side sill is made to pass through the coating furnace and to fill the side sill with the foamed material and hence, it is possible to obtain advantageous effects that the installation cost is hardly necessary, man-hours can be reduced compared to a foamed material injecting method, the method does not cause environmental contamination, and the foamed material does not scatter to the outside of the sill so that the quality of a coated surface is not damaged.

#### 4. Brief Explanation of the Drawings

Fig. 1 is a side view showing a side sill portion of an automobile, Fig. 2 is a cross-sectional view taken along a line A-A in Fig. 1 showing the constitution of a conventional side sill, Fig. 3 to Fig. 6 are views showing the constitution of an embodiment of a side sill of this invention, Fig. 7 and Fig. 8 are views showing an example of the method for manufacturing the side sill of the present invention, Fig. 9 and Fig. 10 are

views showing another example of a method for manufacturing the side sill of the present invention, Fig. 11 is a cross-sectional view showing another embodiment of the constitution of the heating type foamed material in the manufacturing method shown in Fig. 9 and Fig. 10, and Fig. 12 is a characteristics curve diagram of heating type foam material in the manufacturing method shown in Fig. 9 and Fig. 10.

1 ... side sill, 2 ... outer panel of side sill, 3 ... inner panel of side sill, 4 ... floor panel, 5 ... foamed material, 5 ... non-foamed liquid, 5b ... heating type foam material, 6, 7, 7', 8, 8' ... hollow pipe, 9 ... plate, 10 ... gun, 11 ... substrate, 12 ... glass sheet, 13 ... vinyl, 14 ... tacky adhesive agent, 15 ... peelable sheet

(In the drawings)

(Fig. 12)

volume, hardness

time

heating started

foaming started

hardening reaction started

foaming completed

hardening reaction completed

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